WE CLAIM:

1. A router for polarized light, comprising:

a magneto optic rotator (MOR) for controllably rotating a polarization angle of said polarized light; and

a polarization beam splitter (PBS) for accepting said polarized light from said MOR, and routing said light according to said polarization angle.

2. The router of claim 1, wherein said MOR comprises:

a first section, wherein in said first section a magnetic field is selectively switched between two modes, and wherein in said two modes said magnetic field has equal magnitudes and opposite directions, whereby in said first section said polarization angle is rotated by a fixed magnitude and selectively in opposing directions; and

a second section following said first section, wherein in said second section a permanent magnetization prevails, whereby in said second section said polarization angle is rotated by a constant value.

3. The router of claim 2, wherein in said first section said fixed magnitude of said polarization angle rotation is approximately 45°, whereby said polarization angle in said first section is selectively rotated approximately by either + 45° or - 45°, and in said second section said constant value of said polarization angle rotation is approximately

+ 45°, whereby said polarization angle, upon said polarized light passing trough said first section and said second section, is selectively rotated approximately by either + 90° or by 0°.

4. The router of claim 2, wherein said first and said second sections of said MOR are waveguides, wherein each of said waveguides comprising a magneto-optically active layer guiding said polarized light.

5. The router of claim 4, wherein said first and said second section waveguides further comprising at least one additional optical layer, said additional layer interfacing with said magneto-optically active layer, wherein said additional layer having a lower refractive index than said magneto-optically active layer.

6. The router of claim 4, wherein said first and said second section waveguides comprising a sandwich structure, wherein in said sandwich structure said magneto-optically active layer being disposed between two other optical layers, wherein said other optical layers having lower refractive indexes than said magneto-optically active layer.

7. The router of claim 4, wherein said magnetic field in said first section of said MOR is generated by a current flowing in a metallic strip, wherein said metallic strip substantially covering said first section.

8. The router of claim 5, wherein said magneto-optically active layer comprising of Yttrium Iron Garnet (YIG), and said additional optical layer comprising Gadolinium Gallium Garnet (GGG).

9. The router of claim 6, wherein said magneto-optically active layer comprising of Yttrium Iron Garnet (YIG), and wherein at least one of said two other optical layers comprising Gadolinium Gallium Garnet (GGG).

10. The router of claim 1, wherein said router is part of an optical waveguide network.

11. The router of claim 10, wherein said PBS is an optical element constructed into said optical waveguide network.

12. The router of claim 11, wherein said PBS is a vertical polarization grating etched into said waveguide network.

13. The router of claim 11, wherein said PBS is a Brewster angle beam splitter etched into said waveguide network.

14. The router of claim 11, wherein said PBS is a birefringent prism built into said waveguide network.

15. The router of claim 10, wherein said PBS is having asymmetric waveguide output arms, wherein each of said waveguide output arms is capable of propagating light only with one predetermined polarization angle.

16. A routing method for polarized light in an optical waveguide network comprising the steps of:

controllably rotating a polarization angle of said polarized light in a magneto optic rotator (MOR), wherein said MOR being a segment of said optical waveguide; and

accepting said polarized light from said MOR and routing said light along an optical path by a polarization beam splitter (PBS), in accordance with said polarization angle.

17. The routing method of claim 16, wherein the step of controllably rotating a polarization angle further comprising the steps of:

selectively switching a magnetic field between two modes in a first section of said MOR, wherein in said two modes said magnetic field has equal magnitudes and opposite directions, whereby in said first section said polarization angle is rotated approximately by either + 45° or by - 45°; and

rotating by a constant value of + 45° said polarization angle in a second section of said MOR, wherein said second section following said first section, an wherein in said second section a permanent magnetization prevails, whereby said polarization angle,

upon said polarized light passing trough said first section and said second section, is selectively rotated approximately by either + 90° or by 0°.

18. The routing method of claim 17, wherein said steps of selectively switching said magnetic field and rotating said polarization angle by a constant value, are carried out by using in both said first and said second sections of said MOR waveguide a magneto-optically active Yttrium Iron Garnet (YIG) layer guiding said polarized light, and a Gadolinium Gallium Garnet (GGG) layer interfacing with said YIG layer, wherein said GGG layer having a lower refractive index than said YIG layer, and wherein said step of selectively switching said magnetic field comprises a current in a metallic strip, wherein said metallic strip substantially covering said first section.

19. The routing method of claim 16, wherein said step of routing said light in accordance with said polarization angle is carried out by selecting a type of said PBS which is constructed into said optical waveguide network.

20. The routing method of claim 16, wherein said step of routing said light in accordance with said polarization angle, is carried out by said PBS which functions based on having asymmetric waveguide output arms, wherein each of said waveguide output arms is capable of propagating light only with one predetermined polarization angle.

21. In an electronic processor comprising a plurality of processing units, an optical backplane, comprising:

a network of optical waveguides, said optical waveguides guiding polarized light;

routers for polarized light in vertexes of said network of optical waveguides; and

optical devices for operationally connecting said processing units of said electronic processor to said network, wherein said network affords an optical interconnection amongst said processing units.

22. The optical backplane of claim 21, wherein said optical waveguides are planar waveguides.

23. The optical backplane of claim 21, wherein said optical waveguides are strip waveguides.

24. The optical backplane of claim 21, wherein said optical waveguides are cylindrical waveguides.

25. The optical backplane of claim 21, wherein said routers for polarized light are as recited in claim 1.

26. The optical backplane of claim 25, wherein in each of said routers for polarized light said MOR comprising:

a first section, said first section comprising a magneto-optically active Yttrium Iron Garnet (YIG) layer guiding said polarized light, and a Gadolinium Gallium Garnet (GGG) layer interfacing with said YIG layer, wherein said GGG layer having a lower refractive index than said YIG layer, said first section further comprising a metallic strip, wherein said metallic strip substantially covering said first section, wherein a current flowing in said metallic strip generating a magnetic field in said first section, wherein said magnetic field being selectively switched between two modes, and wherein in said two modes said magnetic field has equal magnitudes and opposite directions, whereby in said first section said polarization angle is selectively rotated approximately by either + 45° or - 45°; and

a second section following said first section, wherein said second section comprising a second magneto-optically active YIG layer guiding said polarized light, and a second GGG layer interfacing with said second YIG layer, wherein said second GGG layer having a lower refractive index than said second YIG layer, and wherein in said second section a permanent magnetization prevails, whereby in said second section said polarization angle is rotated by approximately + 45°, whereby said polarization angle, upon said polarized light passing trough said first section and said second section, is selectively rotated approximately by either + 90° or by 0°.

27. The optical backplane of claim 26, wherein said first and said second section waveguides further comprising a third optical layer in a sandwich structure, wherein said YIG layer being disposed between said GGG layer and said third optical layer, wherein said third optical layer having a lower refractive index than said YIG layer.

28. The optical backplane of claim 21, wherein said network of optical waveguides comprising a doped SiO_2 layer guiding said polarized light, and an undoped SiO_2 layer interfacing with said doped SiO_2 layer, wherein said undoped SiO_2 layer having a lower refractive index than said doped SiO_2 layer.

29. The optical backplane of claim 28, wherein said network of optical waveguides further comprising a third optical layer in a sandwich structure, wherein said doped SiO_2 layer being disposed between said undoped SiO_2 layer and said third optical layer, wherein said third optical layer having a lower refractive index than said doped SiO_2 layer.

30. The optical backplane of claim 25, wherein said PBS is constructed into said optical waveguide network.

31. The optical backplane of claim 25, wherein said PBS is having asymmetric waveguide output arms, wherein each of said waveguide output arms is capable of

propagating light only with one predetermined polarization angle.

32. The optical backplane of claim 25, wherein said optical devices for operationally connecting said processing units comprise a prism coupling optics.

33. The optical backplane of claim 25, wherein said optical devices for operationally connecting said processing units comprise a grating coupling optics.

34. The optical backplane of claim 26, wherein said first section and said second section of said MOR, and said network of optical waveguides are being seamlessly meshed together into a coplanar configuration.

35. The optical backplane of claim 26, wherein said first section and said second section of said MOR are external to said network of optical waveguides, and wherein said first and second sections are grating coupled to said network of optical waveguides.

36. The optical backplane of claim 35, wherein said network of optical waveguides guiding a number of wavelengths of said polarized light, and wherein each one of said wavelengths is individually grating coupled to one said external MOR , whereby in said optical backplane the aggregate of said MORs increases proportionally with said number of said wavelengths.

37. A method for providing an optical interconnection amongst processing units of an electronic processor using an optical backplane, comprising the steps of:

guiding polarized light in an optical waveguide network;

routing said polarized light in vertexes of said optical waveguide network; and

operationally connecting said processing units of said electronic processor to said network by optical devices.

38. The method for providing an optical interconnection of claim 37, wherein said routing step is executed as recited in claim 18.

39. The method for providing an optical interconnection of claim 38, wherein said step of routing said light in accordance with said polarization angle, is carried out by selecting a type of said PBS which is constructed into said optical waveguide network.

40. The method for providing an optical interconnection of claim 38, wherein said step of routing said light in accordance with said polarization angle, is carried out by said PBS having asymmetric waveguide output arms, wherein each of said waveguide output arms is capable of propagating light only with one predetermined polarization angle.

41. While providing an optical interconnection amongst processing units of an electronic processor using an optical backplane, said backplane comprising an optical waveguide network, and said network having optical routers at its vertexes, a method for directing communication amongst said processing units, comprising the steps of:

keeping track of a state of said optical backplane;

accepting requests for communication from one or more of said processing units;

identifying one or more available optical paths on said optical backplane, wherein said available optical paths connecting said processing units in need of communication;

setting conditions of said optical routers along said one or more available optical paths, wherein said conditions allow for transmitting light along said one or more available optical paths; and

directing said processing units in need of communication to execute said communication.

42. A computer data signal embodied in a carrier wave encoding a computer program of instructions for executing a computer process performing the steps for directing communication between processing units, as recited in the steps of claim 41.